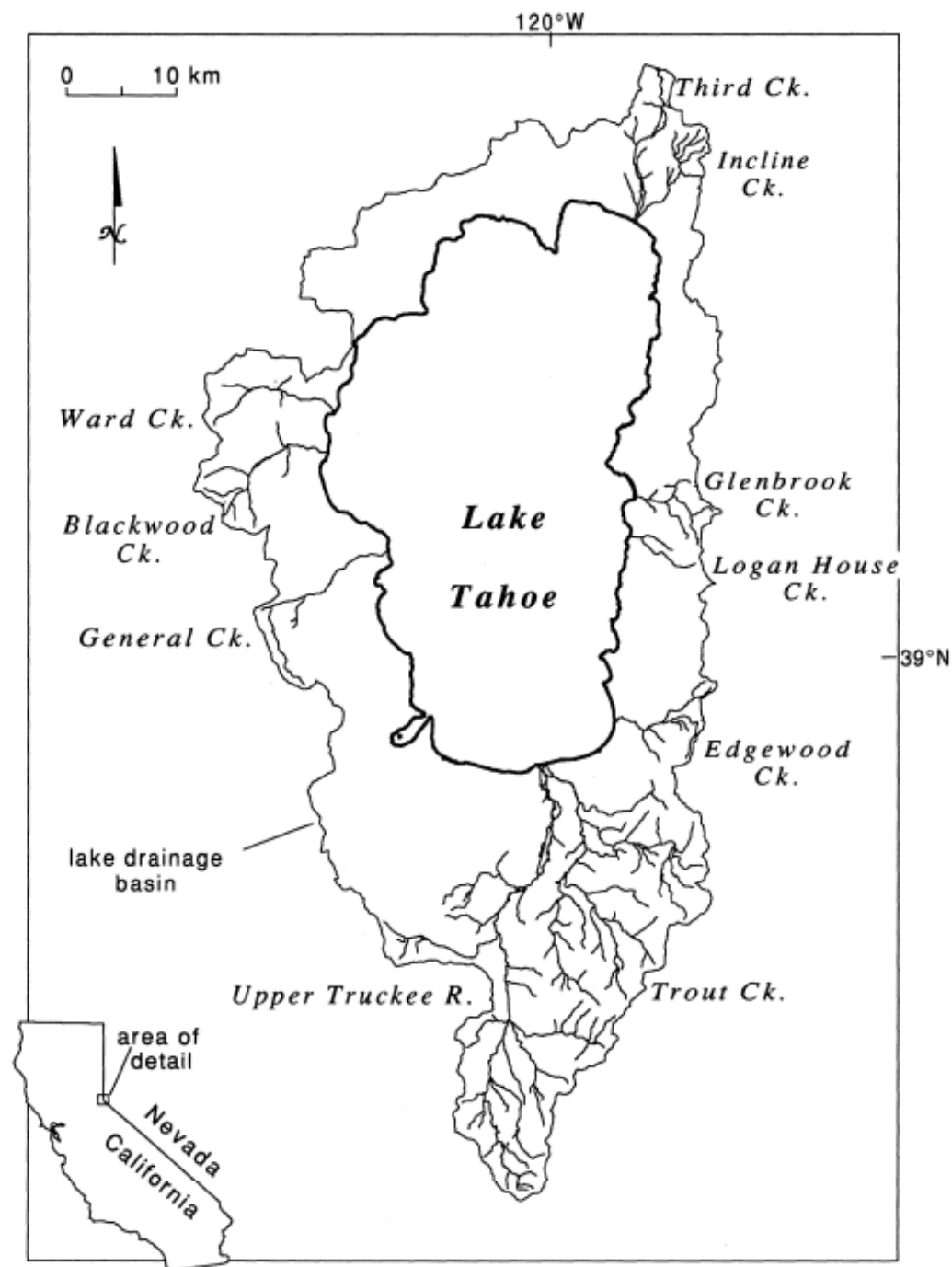# Relating Water Quality to Watershed Attributes: A TMDL Progress Report

Objectives:

- To develop quantitative relationships between water quality and catchment attributes

- Provide information for the TMDL water quality model

Data Sources

- LTIMP water quality data for 20 stations, 1993-2000

- GIS data layers from
    - US Forest Service
    - TRPA
    - USGS
    - New Information
        - IKONOS
        - Down-scaling of Met. data

120°W

0   10 km

N

Third Ck.

Incline Ck.

Ward Ck.

Blackwood Ck.

General Ck.

Lake Tahoe

Glenbrook Ck.

Logan House Ck.

39°N

Edgewood Ck.

lake drainage basin

Upper Truckee R.

Trout Ck.
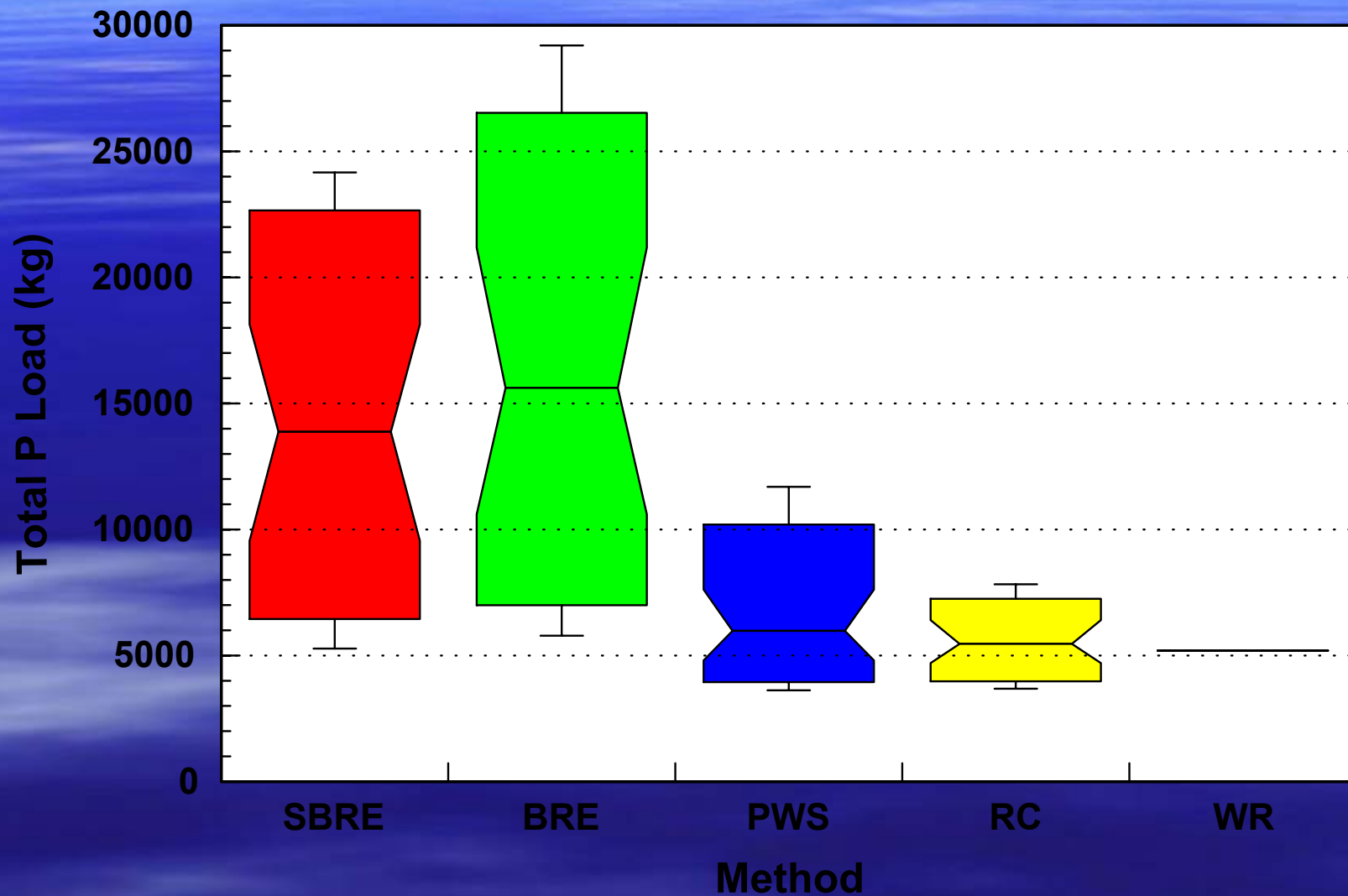
area of detail

Nevada

California

Primary LTIMP Data—Dependent variables

- Instantaneous concentration of:
  - Nitrate-N
  - Ammonium-N
  - TKN
  - SRP
  - Total P
  - Biol. Available Fe
  - Suspended Sediment Conc.

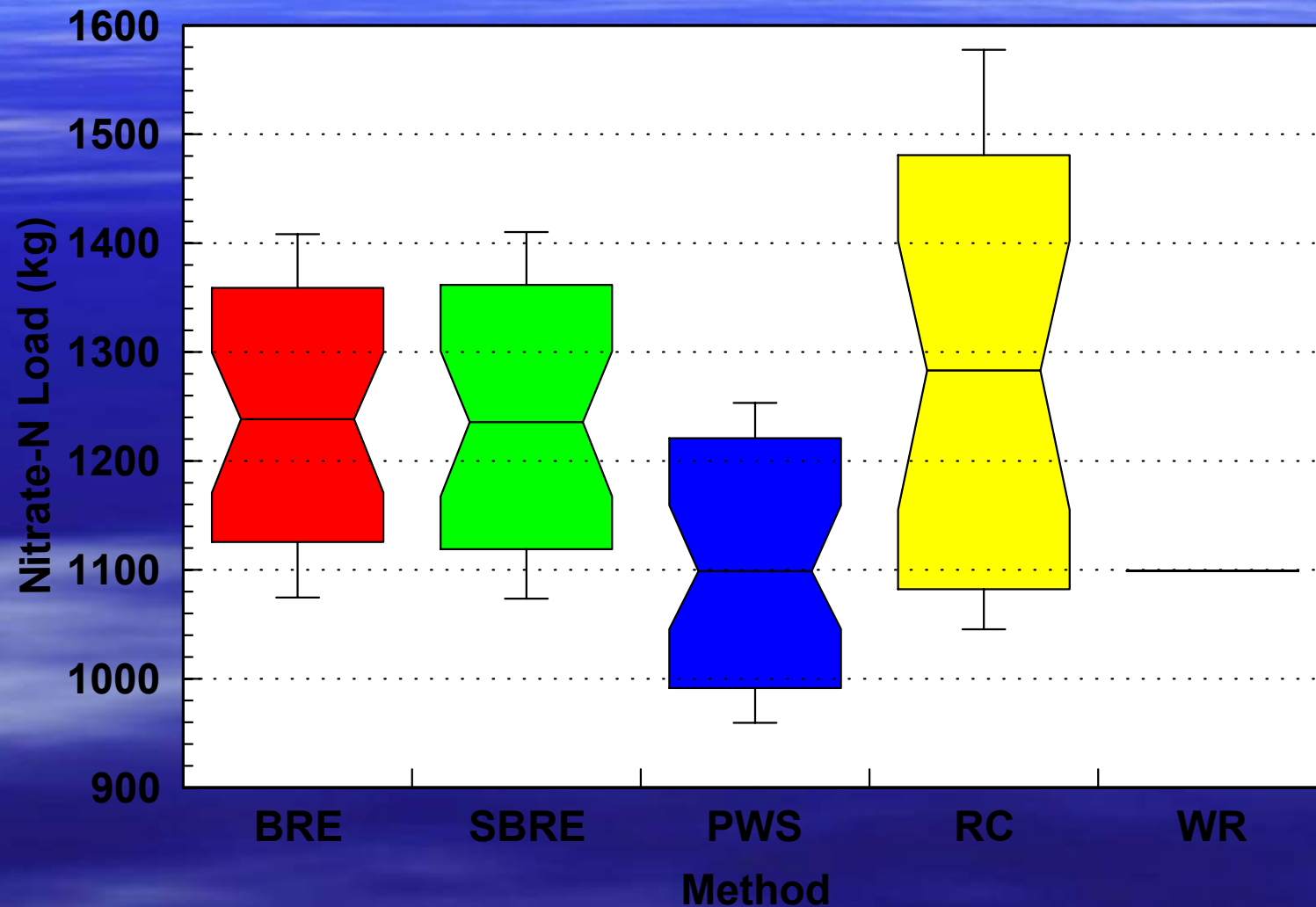- Instantaneous Discharge (Qi)

- Mean Daily Discharge (Qd)

Derived from LTIMP Data--Dependent Variables

- Discharge-weighted mean concentration at 20 stations, 1993-2000*

  - At a station:
    $(\sum Q_i C_i)/\sum Q_i$

  - Between stations:
    $\sum(Q_{i2}*C_{i2} - Q_{i1}*C_{i1})/ \sum(Q_{i2} - Q_{i1})$

- Total and Ave. Ann. Load, for 20 stations

  - Period-weighted sample method, for dissolved constituents

  - Regression method for particulate constituents

A Monte Carlo Test of Total P Load by Four Methods, 200 trials using 40 Samples drawn from 132 real samples

A Monte Carlo Test of Nitrate-N Load by Four Methods, 200 trials using 40 Samples drawn from 132 real samples

Primary Data for Urbanized Areas—Dependent Variables

- Concentration in Flow-weighted composite samples
  - Nitrate-N
  - Ammonium-N
  - TKN
  - Total P
  - Dissolved P
  - SRP
  - SSC
- Instantaneous Discharge

Derived Data for Urbanized Areas

- Event Mean Concentrations

- Event Discharge

Independent Variables

- **Hydrology**
  - Mean ann. Precip. (cm) *
  - River density (km/km^2) *
  - Alluvial & Riparian Rivers (pct.)*
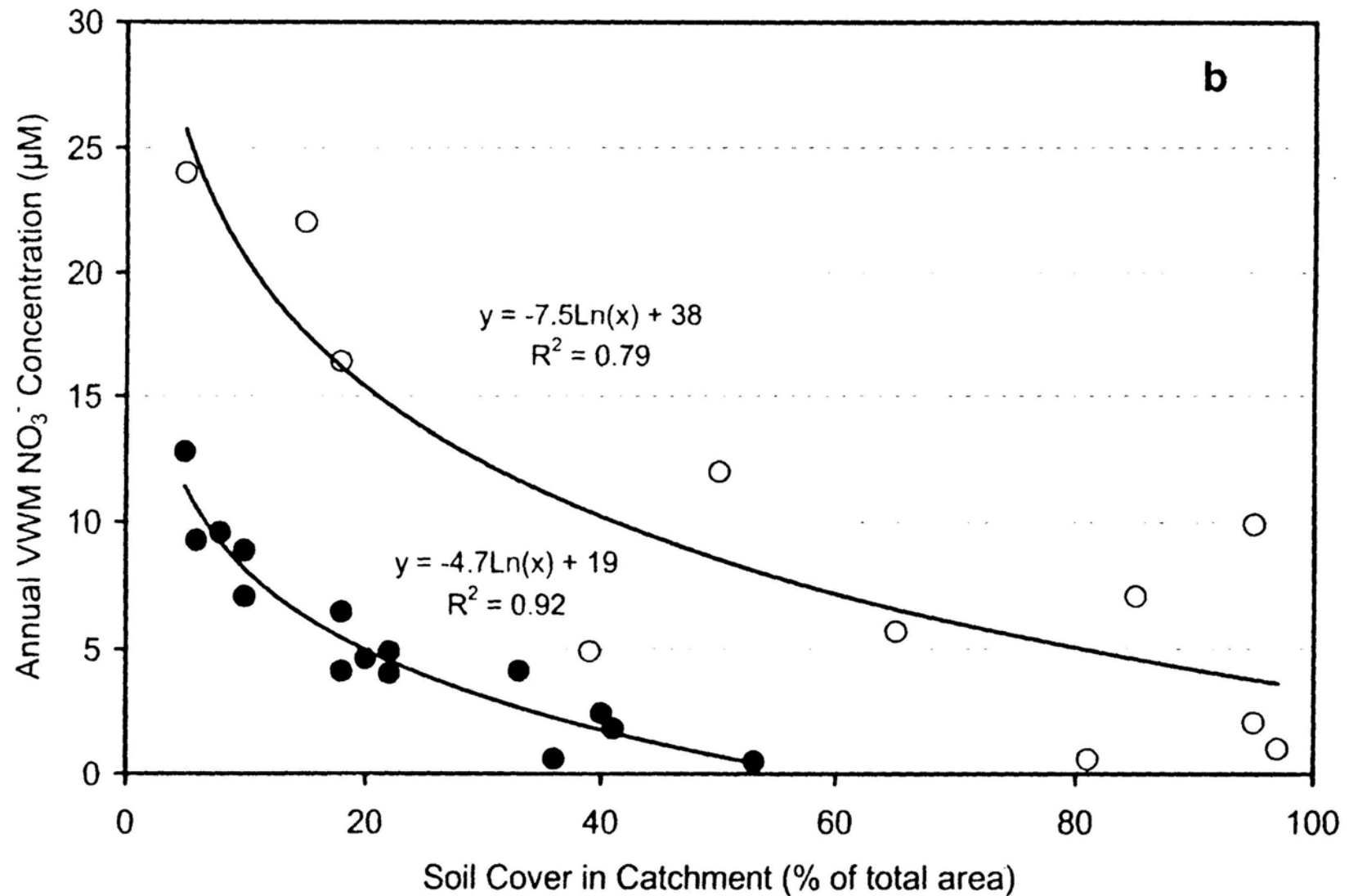 - Flow Regime

- **Geology/soils/geomorph.**
  - Volcanic soils (pct.)*
  - Granitic Soils (pct)*
  - Area-wtd. Site Class*
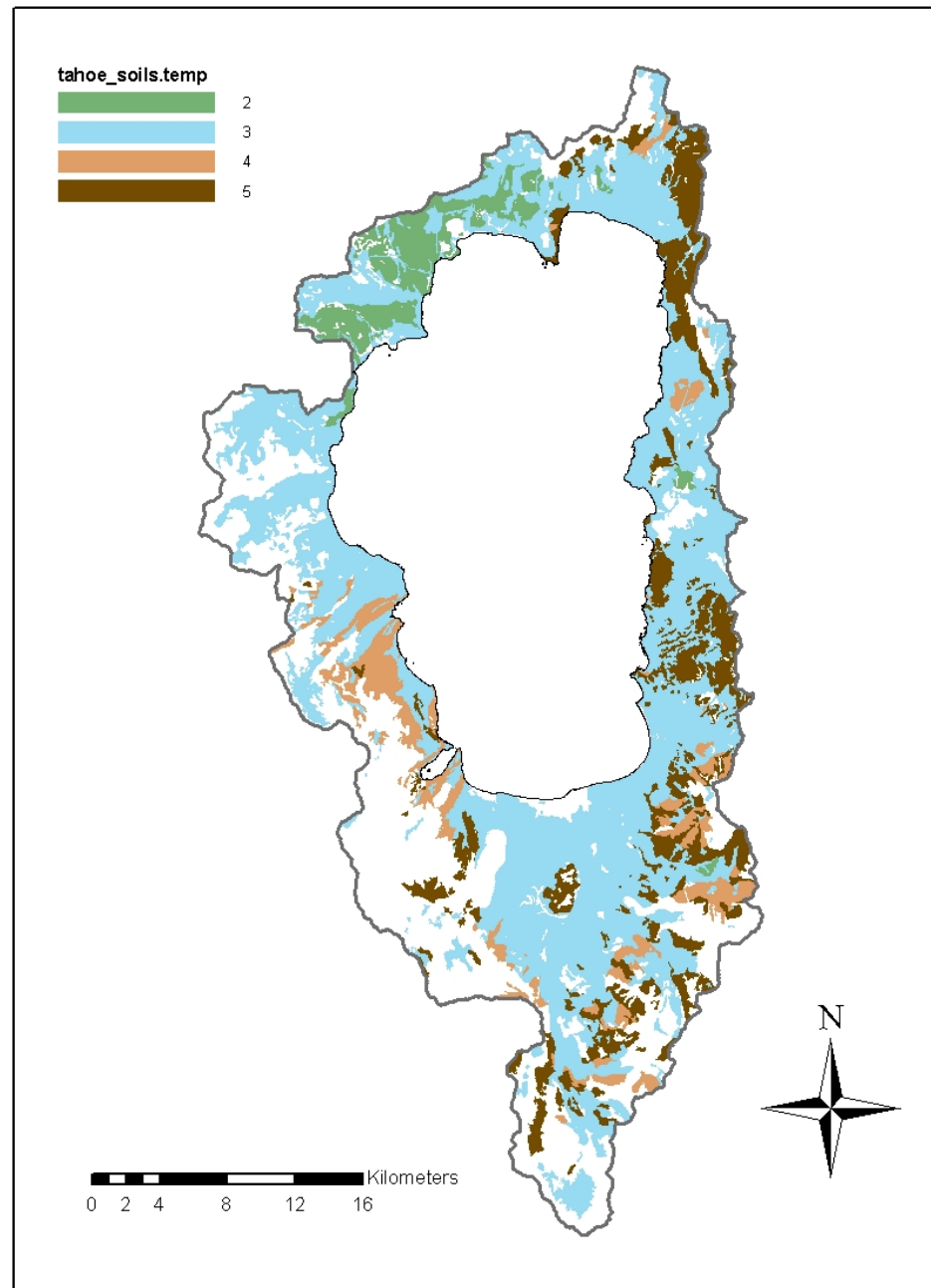 - Unwtd. Ave. slope*
  - Flowpath-wtd. Slope*

- **Land Use**
  - Low-intensity residential (pct.)*
  - Commercial/indust. (pct)*
  - Hazard class by land use (pct)
  - Unimp. Dirt roads (km/km^2)*
  - Residential roads (km/km^2)*
  - State/Fed. Highways (km/km^2)*
  - Impervious surface (pct.) from IKONOS data

Q-wtd. Mean Nitrate-N Concentration,
Sierra Nevada (●) and Rocky Mountains (○)
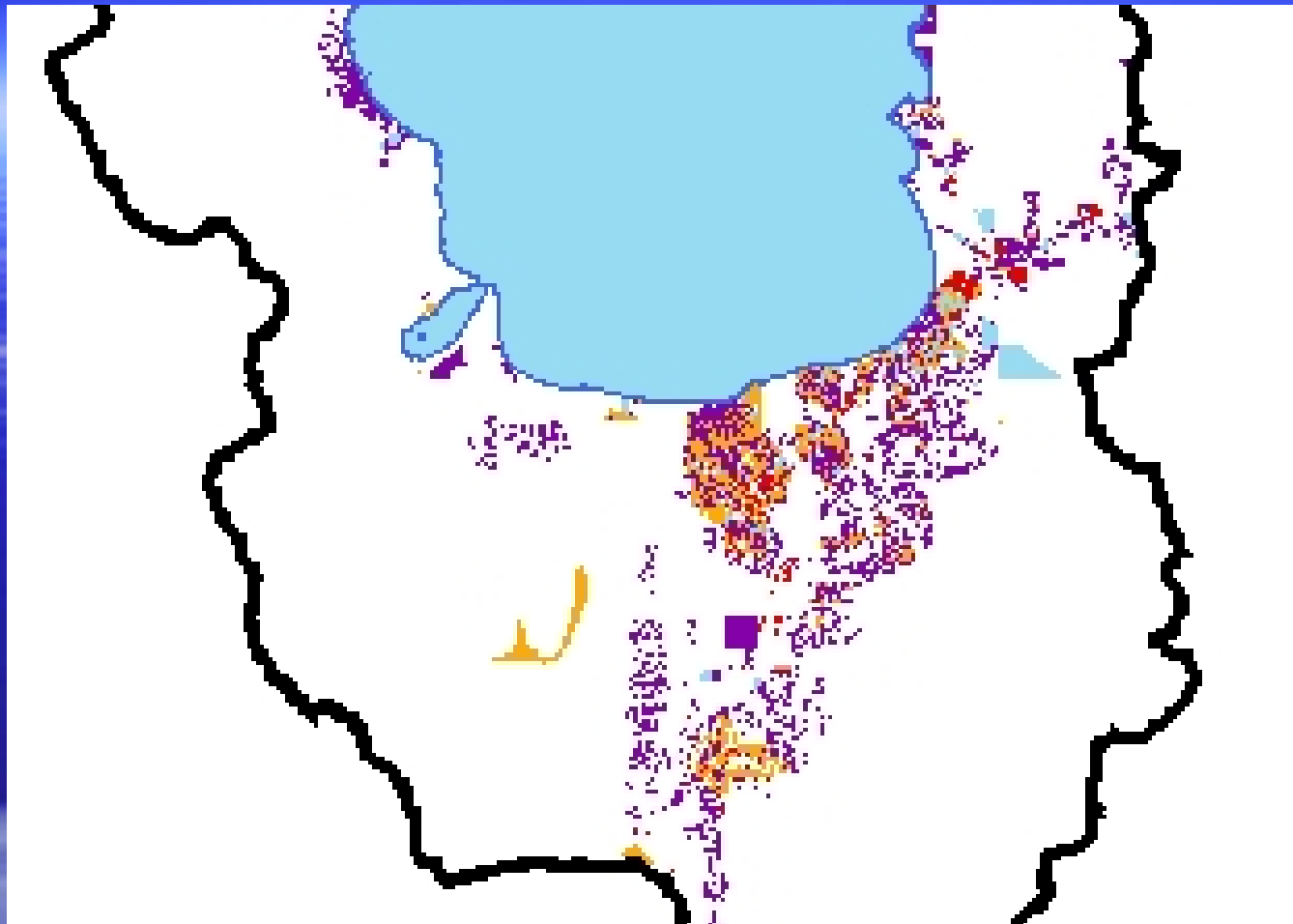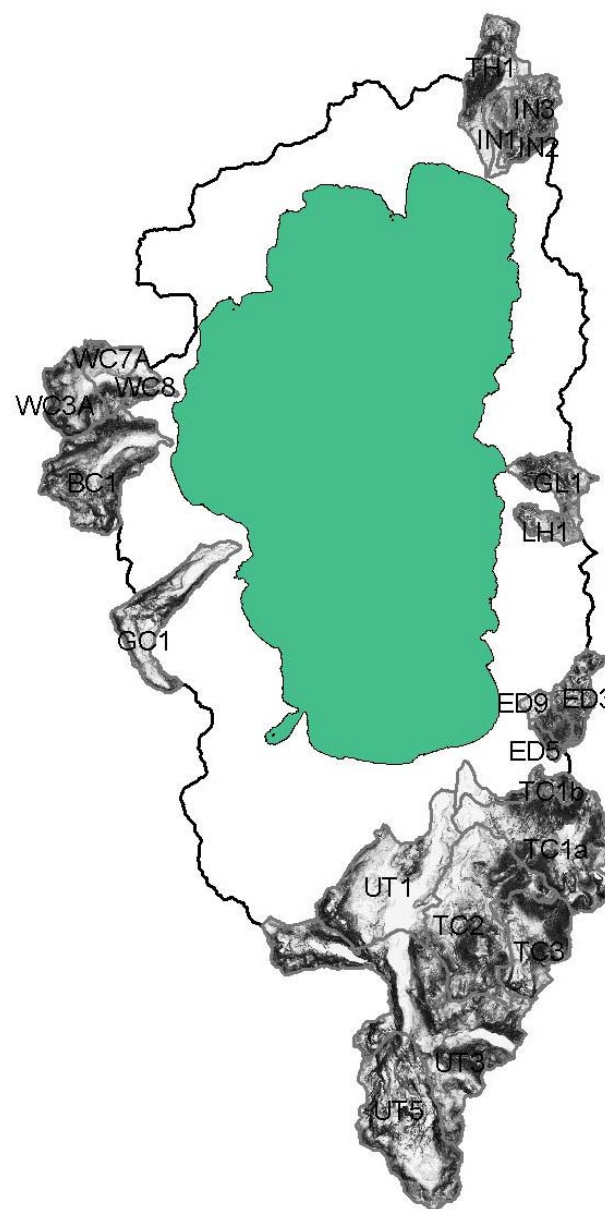**(Sickman *et al.*, 2002)**

Site Class (Rogers, 1974)

Riparian Zones

Land Use Catagories, from TRPA
Red= Commercial
Yellow = mixed urban
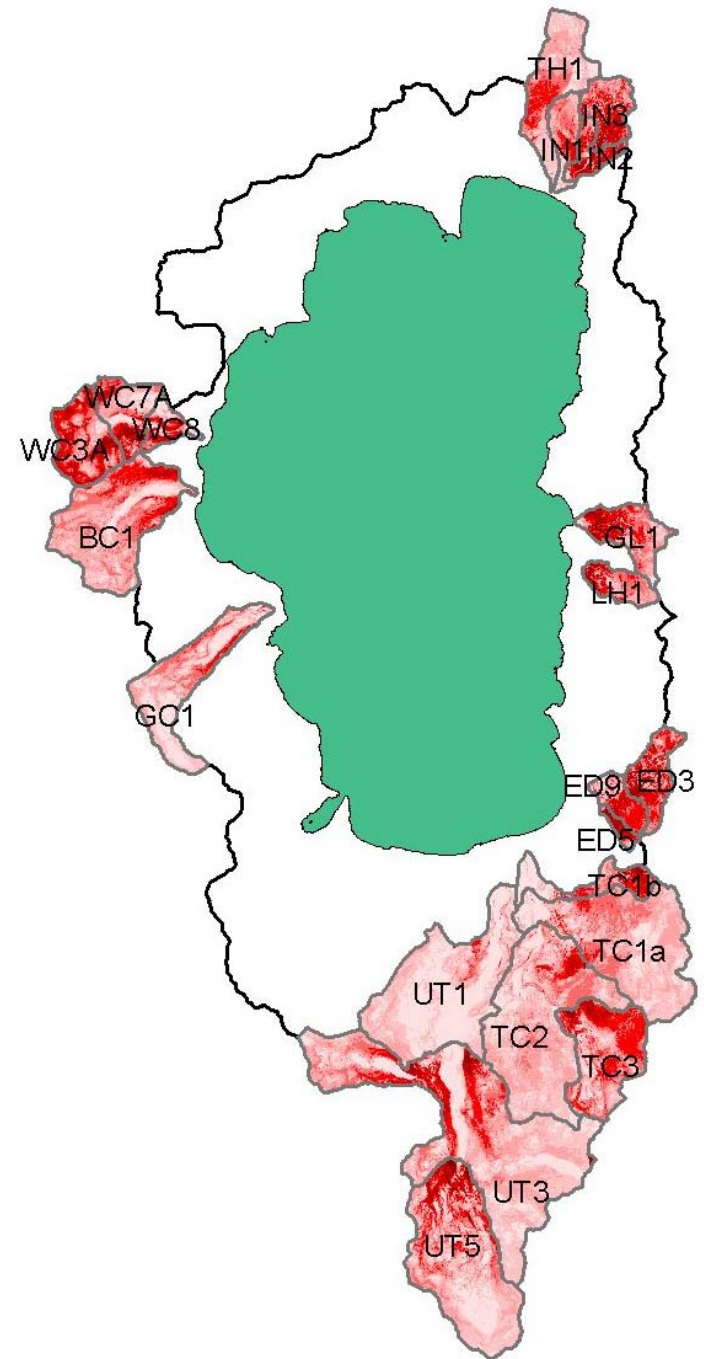Blue, Purple = residential

Unweighted Slope

Flowpath Length-Discounted Slope
$$S' = S*e^{-KL}$$
(L=Hydrologic flowpath length, m
$k=10^{-4}$)

Unweighted – Weighted Slope